



# Automated Early Warning Systems for Lock Gate Condition

## Problem

An inexpensive method is needed to monitor structural and electrical-mechanical component behavior for detection and prediction of degraded conditions that indicate imminent catastrophic lock gate failure, as well as to report current status to the lock operator so that actions may be taken to avoid catastrophic gate failure.

## Approach

SMART Gate 2.0 is a fully-automated data-to-decision support system for the condition assessment of miter lock gates. An optimized and affordable sensing system provides data to high-fidelity simulation and surrogate numerical models. Statistical pattern recognition enables the detection of specific events that may eventually result in catastrophic conditions. 'Catastrophic status' is delivered to the lock operator through LOMA. Currently, detection targets are gate impact, dragging of debris, and quoin-to-wall contact degradation. This R&D will expand capabilities for lock monitoring and will be applicable to other types of gates and structures.



## Products

A guidance document will be written which describes, in detail, the steps required to design, purchase, and implement an automated early warning system for lock gates and its incorporation into the SMART Gate framework. The system will initially be designed to detect dragging of debris, impacts to the gate, and degraded quoin-to-wall contact. The SMART Gate framework will be augmented to support the new early warning capability. It will provide real-time signals to the lock operator through the Lock Operation Management Application (LOMA) and archived data to other USACE personnel via the internet.

## Benefits

Minimizing catastrophic failures will provide a reduction in unscheduled closures, thus providing cost savings and increasing safety for both the Corps and the waterways industry. This research will create an integrated, affordable real-time navigation lock gate monitoring and early warning system to aid the lock operator in identifying adverse lock conditions before they cause a catastrophic failure. USACE lock operators will receive condition signals to alert them of an impending issue with gate operation. USACE District engineers will have access to archived condition data to help in assessing the health of the gate structures. Having a real-time automated early warning system which detects impacts, dragging of debris, and degraded quoin-to-wall contact will help prevent operation of gates during conditions which may lead to an unscheduled lock outage or catastrophic failure.

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